TNRCC TECHNICAL GUIDANCE

INDUSTRIAL & HAZARDOUS WASTE

SUBJECT: Volume to Weight Conversion Factors for Waste Handlers

The Texas Natural Resource Conservation Commission (TNRCC) must report to the Environmental Protection Agency (EPA) every other year in a format specified by the EPA headquarters in Washington. This "Biennial Report" is a summary of hazardous waste generation and management activities in Texas. The EPA requests that waste be reported in units of weight or that the density of the waste be reported also, so that volume units can be correctly converted to units of weight.

In the past, the TNRCC allowed waste handlers (generators and receivers) to report their wastes in units of volume (e.g. gallons) on their monthly and annual reports and the TNRCC made the conversions to units of weight. However, in order to adhere to the EPA reporting requirements, the TNRCC began requiring facilities to report all reportable wastes in units of weight (e.g. pounds, kilograms or tons) on January 1, 1993.

The information that follows is designed to help handlers who know the volume of a waste but not the weight of the waste.

This guidance explains three (3) methods (other than simply weighing the entire volume of a waste) by which a waste handler may determine the weight of a waste.

METHOD 1:
The handler knows the Density and Volume of the waste.

If a handler knows the density of a waste (i.e. its weight per unit volume), the handler can calculate the weight of the waste by using the following formula:

Density of the waste x Volume of the waste = Weight of the waste

Example: A handler knows that the density of a waste is 11.5 lbs. per gallon. The handler also knows that there are 50 gallons of the waste. The weight of the waste can be calculated as follows:

11.5 lbs./gal. x 50 gal. = 575 lbs.

METHOD 2:
The handler knows the Volume and Weight of a representative sample of the waste.

The formula for using Method 2 is:

(Volume of original waste ÷ Volume of sample) x Weight of sample = Weight of the original waste

The steps in using Method 2 are:

(1) obtain a representative sample of a known volume of the waste whose weight is being calculated;
(2) weigh the sample;
(3) calculate the number of such samples in the original waste by dividing the volume of the original waste by the volume of the sample; and
(4) multiply the number obtained in step 3 by the weight of the sample to obtain the weight of the original waste.

Example: A handler has 9500 liters of a liquid waste but does not know the specific gravity of the waste and wishes to know how much the liquid weighs. Using Method 2, the generator may calculate the weight of the liquid waste as follows:

(1) take a representative sample of a known volume of the liquid waste (for this example, let us say that the volume of the representative sample is 2 liters);
(2) obtain the weight of the sample taken in step 1 by weighing it (for this example, let us say that the weight of the sample is 3 kilograms);
(3) divide the volume of the original waste (i.e. 9500 liters) by the volume of the sample (i.e. 2 liters) to obtain the result of 4750 (i.e. 9500 ÷ 2 = 4750); and
(4) calculate the weight of the original waste by performing the following calculation using

the Method 2 formula. (9500 liters ÷ 2 liters) x 3 kilograms = 14,250 kilograms. The weight of the original 9,500 liters of liquid waste is 14,250 kilograms.

METHOD 3:

The handler knows the Specific Gravity and Volume of the waste.

The first requirement for using this method is that the handler knows the specific gravity (i.e. the ratio of the weight of the substance to the weight of an equal volume of water) of the waste whose weight is being calculated. The second requirement is that the units associated with the volume of the waste be the same as the weight of the volume of water used as a reference. This means, if the volume of the waste whose weight is being calculated is expressed in cubic yards, then the corresponding water weight reference must also be in cubic yards. For example, calculating the weight of 1 cubic meter of lead, while using the water reference weight of 1 cubic yard of water is "bad science". (Note: The specific gravity of your waste can generally be obtained from a Material Safety Data Sheet, manufacturers literature, materials handbooks, or, if you ask, from your laboratory).

The formula for using this method is:

Weight of water per unit volume x Specific gravity x Volume of waste = Weight of waste

Example 1: Lead has a specific gravity of 11.35 (i.e. a given volume of lead weighs 11.35 times as much as an equal volume of water). The weight of 1 cubic foot of water is approximately 62.3 lbs./cu. ft. Given this information, the weight of 2 cubic feet of lead would be calculated as follows:

62.3 lbs./cu. ft. x 11.35 x 2 cu. ft. = 1,414.2 lbs.

Table 1 contains information that will enable you to determine the weight of water for several commonly encountered units of volume. Table 2 contains information that may be helpful to you in converting from 1 unit of volume to another (e.g. from cubic feet to cubic meters).

TABLE 1
Common Units of Volume and Their Equivalent Weights of Water

One Cubic Foot = 62.3 Pounds
One Cubic Yard = 1,682.1 Pounds
One Cubic Meter = 2,222.8 Pounds
One Cubic Centimeter = 0.00022 Pounds
One Cubic Inch = 0.0361 Pounds
One Gallon = 8.34 Pounds
One Liter = 2.205 Pounds

TABLE 2
Other Helpful Conversion Factors

One Cubic Foot = 0.037 Cubic Yards
One Cubic Foot = 0.0283 Cubic Meters
One Cubic Foot = 1,728 Cubic Inches
One Cubic Foot = 28.32 Liters
One Cubic Foot = 28,318 Cubic Centimeters
One Ton (Non-Metric) = 2,000 Pounds
One Gallon = 4 Quarts
One Quart = 0.946 Liters
One Gallon = 3.785 Liters
One Liter = 1,000 Milliliters
One Kilogram = 2.205 Pounds

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